Photonics technologies are ubiquitous. Earmarked by the European Commission as a Key Enabling Technology for the 21st Century, photonics equipment is used across quantum computing applications, agricultural technologies, Internet of Things devices, self-driving cars, and healthcare tech, amongst many others.

Europe has had a distinguished history in scientific and technical research with regards to the potential of light as a source of technological development. But where does it stand today? How does the continent’s SME landscape make the most of photonics research and funding? How does Europe compare with other global players in the market? What are some of the success stories of photonics projects in Europe?

In this five-part special report, EURACTIV digs deeper to answer some of the above questions as a means of charting Europe’s future in the field of photonics tech and finding out how light continues to be a valuable source of digital development.
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Europe has a long and rich history of harnessing the power of light to extend the technical and practical capacities of the human species. The modern-day utilisation of light for such means takes its form in the technology of photonics, and today, Europe’s clout in the arena is formidable.

Currently, the continent ranks second only to China in the global photonics market, and projections estimate that the sector could attain a compound annual growth rate of 8.6% leading up to 2022.

While today photonics technologies are used in high-tech applications such as quantum computing applications, Internet of Things devices, wearable devices, self-driving cars, and healthcare technologies, the origin of Europe’s relationship with light technologies stretches back millennia.

In order to unlock the technological Continued on Page 5
possibilities of tomorrow, our ancestors first had to wrestle with the mystifying theoretical foundation of the material property known as light, and it befell one of Europe’s most dominant civilisations, the ancient Greeks, to first pursue this tract.

One of the earliest influential documentations on materials theories of light appeared in mathematician Euclid’s treatise on vision, whose earliest surviving manuscript dates from the 10th century.

Euclid’s postulated over the geometrical properties of light – leading him to conceptualise the law of reflection. Euclid, along with Greek mathematician Ptolemy, subscribed to what is known as emission theory – the notion that the visible perception of things occurred as a result of the eyes themselves emitting rays of light.

Inspired by Euclid and Ptolemy’s work, the Arab mathematician Ibn al-Haytham hypothesised that the objects themselves radiate light.

The next most relevant development on photonics back in Europe came by way of Isaac Newton’s work in the 17th century. Based on his renowned prism experiment, he concluded that “light is a mixture of various colours having different refractivity,” which eventually formed the basis for his Light Particle Theory as outlined in the 1704 title Opticks.

One of the main opponents to Newton’s theory was the Dutch mathematician Christiana Huygens, who, being inspired by Rene Descartes’ 1637 treatise, Dioptics, believed that light took the form of waves.

**PLANCK AND EINSTEIN MAKE THE LEAP**

But it finally fell upon Max Planck and then Albert Einstein to make the greatest scientific leaps in photonics research, and reveal the true nature of light.

Planck’s contribution to the world of quantum physics was a momentous leap in the pursuance of photonics technologies. In 1900 Planck managed to find an association between the amount of energy that a photon is able to carry and the frequency of the wave by which it travels – giving rise to the now famous ‘Planck’s Constant’ theory.

In 1905, Einstein published a paper refuting the commonly accepted proposition that a light-beam is a wave travelling through space, contending instead that it is an amalgam of discrete wave ‘packets,’ later dubbed ‘photons,’ that each contain a quantity of energy. Einstein discovered that as part of the photoelectric effect, the phenomena of photons striking elections, light was never made up of merely waves nor particles, but in fact both.

Einstein has settled the age-old theory on the material properties of light, and in so doing, was awarded the 1921 Nobel Prize for Physics.

Einstein is the father of modern photonics technologies, and without his findings, many of the applications used across Europe’s optical industries would probably never have come into being.

In terms of European innovation, Einstein’s work became fundamental in many later technological developments, including Hungarian-British scientist Dennis Gabor’s 1948 invention of holograms, and more modern applications, such as the University of Regensburg in Germany’s research into how laser-light pulses can be used in quantum computing.

**REVOLUTIONARY POTENTIAL**

More broadly, from computer screens to lasers in healthcare devices and solar panels, from cameras in smartphones to optical fibre technologies, the revolutionary potential of photonics has been recognised by the European Commission as a Key Enabling Technology of the 21st century.

In this vein, a 2018 report by the European Investment Bank recognised the potential of photonics technologies to enrich and extend the capabilities of other next-generation applications, which, without Europe’s history in scientific research, would never have been possible.

“Deep tech applications such as artificial intelligence, big data, additive manufacturing, robotics, the Internet of Things (IoT), and autonomous driving will require faster, more reliable, more energy efficient and more powerful photonics and semiconductor components,” the report states.

“The success of Europe in this next wave of innovation will ultimately depend on photonics and semiconductor components.”

With Europe’s valiant scientific excursions into the theory of light and photoelectric research being well-established, there are also those who have touted photonics as an area in which the wider political goals of the European Union can be pursued.

While the Von der Leyen Commission has been quick to employ the term ‘sovereignty’ across the digital and data fields, there are those who believe that amid the current global economic climate, Europe must place an emphasis on an industry that bears the development of so many other technologies.

A recent paper entitled Exploration of Photonics Markets, published by the industry lobby Photonics21, found that China’s annual spending in photonics will hit €1 billion in 2020.

There are concerns that Europe’s well-established research in light technologies could fall by the wayside while larger global players commit to substantial investments.

A December 2018 letter penned Continued on Page 6
by leading scientists in the field brought these concerns to the fore, highlighting the importance of photonics technologies playing a central role in the Digital and Industry section of the next Horizon budget 2021-2027.

Carlos Lee, director-general of the European Photonics Industry (EPIC), recently told EURACTIV that photonics technologies should be heralded as a “European success story.”

And, looking at the figures, it’s hard to disagree. Estimates published by EPIC show that the photonics sector, built up predominantly of SMEs, features around 5,000 companies that have created more than 300,000 skilled jobs, with an annual turnover of €60 billion.

These fast-growing figures are a testament to Europe’s intellectual, scientific and philosophical history in theorising the properties of light, and how such a source can be harnessed to transform our technological landscape.

Only time will tell whether the continent will be able to distinguish itself further in this domain by ensuring that photonics remains at the forefront of the technological developments of tomorrow.
For Giovanni Badiali, it is a day like any other. Adorned in the standard surgical attire, he enters the operating room and prepares his medial implements with the patient lying flat before him.

There is one noticeable difference to today’s procedure, however: Badiali pulls a visor over his face and a series of digitised numbers and images appear in front of his eyes. He is about to embark on the world’s first augmented reality operation.

“We didn’t expect to get such a perfectly attuned experience to the surgical procedure,” Badiali, lead surgeon of the operation which took place at Bologna’s Sant’Orsola hospital in February, told EURACTIV.

“We had a real patient both under our hands and under our eyes, the entire experience was heightened. Suddenly I had instant and seamless access to a wide range of data about the patient, which proved to be a vital aid in the operation.”

The procedure itself involved the resecting and repositioning of the upper jaw bone, in order to restore the patient’s biting functionality. For

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an operation such as this, normally an external monitor would be used to analyse vital information about the patient’s condition.

This time around, with the use of a headset developed as part of the EU-funded VOSTARS (Video-Optical See Through AR surgical System) project, that very same data appears in the lens of a visor worn by the lead surgeon.

This allows for a greater focus on the operation, improved monitoring of the patient’s condition, a more timely intervention, as well as better hand-eye coordination on the part of the surgeon.

The data visible through the visor includes the patient’s heart rate, body temperature, blood pressure, and breathing rates, alongside pre-operative information retrieved from imaging technologies used beforehand, including CT, MRI, or 3DUS scans.

GOOD NEWS FOR PATIENTS

For the patients themselves, Badiali explained, the development of such technologies can only have a positive impact on the future efficiency of Europe’s public health services. “We made sure that the patient was well informed about the changes to the nature of this operation,” he said.

“For the patient, there are only benefits to this new way of operating. During the first initial meeting, we explained to them the new devices that we were going to use, as well as all the research that had gone into developing the visor. The patient was excited to be part of the research and they felt safe because the surgical procedure was straightforward, and there was no added risk from the use of the new technology.”

The technology itself had been long in the making.

The VOSTARS initiative is led by Italy’s University of Pisa along with 12 European partners from France, Germany and the United Kingdom. For Project coordinator Dr Vincenzo Ferrari, a biomedical engineering researcher at the Department of Information Engineering at the University of Pisa, the research still holds a lot of potential for the future.

“The possibilities with this technology are comprehensive,” Ferrari told EURACTIV. “It’s now possible to superimpose images onto a surgeon’s visual perception, allowing the doctor to see with an ability that is akin to x-ray vision.”

“With the first results of the VOSTARS project, we have shown that we can overcome technical obstacles to enhance the experience of the surgeon and transmit the data that they would have otherwise had to redirect their field of vision to see,” Ferrari added.

The next steps, he said, are to incorporate a real-time video feed into the visors, so that it becomes possible for the surgeon to follow the movements of implements equipped with cameras as they guide surgical procedures.

“This could help to create perfect alignment between the actions of the surgeon and the data transmitted as part of the footage,” Ferrari said.

ON THE EDGE OF MEDICAL REVOLUTION

The technology that provides the basis for such ground-breaking leaps in surgical operations is based on the use of photonics applications. EURACTIV spoke to Anna Pelagotti from the European Commission’s Photonics’ Unit, who has been following the VOSTARS initiative.

“Imaging devices are used throughout the consultative and pre-operative phases of health service procedures, in order to plan surgeries. What this project does is merge the data analysed during such stages with the surgical stage itself so that the doctor is able to analyse all of the information relevant to the operation,” she said.

“Photonics is the science of light technology, as we define it. It includes not only the transmission of light but also the acquisition of light,” Pelagotti said. “The display used in the VOSTARS project featured many photonics components, which are absolutely vital for these technologies to function.”

Pelagotti added that the project such as the one recently conducted in Bologna is just one of the many others currently established under the Public-Private Partnership (PPP) arrangement between the EU Commission and the European Technology Platform’s Photonics21 Association, within the Horizon 2020 funding framework.

Other ongoing projects include Prometheus, which aims to deliver the next generation in high power ultrashort pulse laser surface processing, and the Galahad initiative, which vies to develop photonics technologies to better detect the onset of age-related visual impairment diseases.

Reflecting on his performance in the operating theatre and being the first surgeon in the world to conduct an augmented reality operation, Giovanni Badiali told EURACTIV that the outcome of the procedure spelled positive things for the future of advanced technologies in hospitals.

“The boundaries of what we can introduce to the surgical field are limited by just our creativity. It’s possible to add datasets that relate to fields of anatomy, pathology, pathways, and pathfinders,” he said. “We are on the edge of a medical revolution in terms of surgical navigation.”

“We could be working seamlessly in the future. For surgeries, this means a great gain of time and a reduction of mental work to do the connections between the virtual and the real. All the information arrives in real time. Time is the greatest beneficiary of this technology.”
Europe’s resilience in the global photonics marketplace

By Samuel Stolton | EURACTIV.com

Europe’s well-established intellectual and scientific history in developing optical technologies has brought the continent to its current position as the second-highest global manufacturer of photonics equipment. With rapid development over recent years, the technology could help the EU to attain its political goal of technological sovereignty.

The EU’s industrial strategy published on Tuesday (11 March), highlighted the need for the bloc to achieve strategic autonomy across a number of sectors vital to driving the bloc’s single market. “Europe’s strategic autonomy is about reducing dependence on others for things we need the most: critical materials and technologies, food, infrastructure, security and other strategic areas,” the document read, adding that the future resilience of the bloc’s technological landscape depends on the EU’s ‘strategic digital infrastructures.’

To this end, a number of key technologies were outlined in the industrial strategy, which could provide European markets with the resilience to ensure that its dependence on extra-territorial players in the field is not too substantial. One such technology is photonics.

Recent studies have shown that it is not only Europe attempting to make headway in the photonics arena. By 2020, the South Korean government has plans to increase photonics investment by €2.8 billion per annum, while the Chinese, who currently sit in the number one spot as photonics manufacturers worldwide, have made commitments to up spending in the field to €1 billion this year.

CHINESE DOMINANCE

However, China’s dominance in the field has been long in the making, particularly in the manufacturing of low-cost optical technologies such as light-emitting diodes (LEDs), using government subsidies and low-interest rates in a similar way to that which invigorated China’s solar and wind turbine markets.

But in the wider lighting marketplace, LEDs have gained in demand over recent years, due to their greater energy efficiency when compared with other lighting sources, using considerably less electricity than both incandescent and florescent light bulbs. Alongside state-supported investments into the LED industry as well as China’s recent efforts to go-green, the sector has remained relatively robust over recent years, despite the recent US trade tensions.

Moreover, on Monday (9 March), a subsidiary of China’s largest LED firm, Sanan Optoelectronics, announced that they would be

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expanding manufacturing services for the global optical market. Sanan Integrated Circuits, which provides equipment for microelectronics and photonics markets said that they plan to broaden operations to “provide the global optical market with large-scale foundry services” for lasers, arrays and other ranges of optical communications applications.

Along this axis, should any dumping attempts by foreign firms onto the European photonics market manifest, the resilience of firms on the continent would be tested. The 2017 insolvency of Europe’s largest solar manufacturer, SolarWorld, was a case in point, leading Milan Nitschke, President of the the European solar association, EU ProSun, to take aim at aggressive Chinese trade practices.

“Anti-dumping measures introduced in 2013 have only been half-heartedly enforced for a long time, allowing further damage to the domestic industry. This situation is due to massive overcapacity in China and state-funded price dumping,” he said.

“Chinese state-owned banks have invested more than €100 billion in manufacturing capacities — more than 1.3 times the world’s total demand. In a market economy, this would be irrational. But, China is focused on winning dominance in one of the world’s most important future-oriented industries, at any cost.”

Not only dumping practices, but technology acquisitions emanating from China have also tested European resilience. From a political perspective, this is a challenging area for the EU to negotiate in attempting to mitigate the risks from stack-backed acquisitions of European private companies.

The ‘Big Three’ of France, Germany and the UK have historically been the largest recipients of Chinese investments, but other countries in the bloc, such as Sweden and Luxembourg, have started to become attractive to China as well.

A 2019 report published by the Rhodium Group (RHG) and the Mercator Institute for China Studies (MERICS) showed that Sweden received €3.4 billion in funding from China in 2018, while Luxembourg attracted €1.6 billion. In the technology domain, such figures had been expected, following Huachanghai Intelligent Equipment’s 2017 acquisition of Sweden’s Robot System Products (RSP).

Such moves are strategic manifestations of several programs initiated by the Chinese state, including the Made in China 2025 project, which aims to turn “Chinese enterprises into world-class, globally competitive firms,” across industries such as robotics, electric cars, self-driving vehicles and artificial intelligence, according to President Xi.

Moreover, in a bid to counter reliance on semiconductor development firms around the world, China has established its own investment program, known as the China Integrated Circuit Industry Investment Fund or ‘Big Fund,’ to foster its home-grown ecosystem for chip and integrated circuit production.

PILOT LINES IN PHOTONICS

Responding to these challenges will be a litmus test of Europe’s ambitions to obtain technological sovereignty and strategic autonomy.

In the photonics field, at least, there have been a series of moves to encourage development in the production of the high-tech applications that could drive Europe’s quest for strategic autonomy.

The EU’s pilot lines project for photonics has borne a series of initiatives that aim to distinguish the technologies being developed here, with the aim of enabling “high-tech SMEs in Europe to take their good ideas, scale-them-up and validate them with customers for commercial production.” Five additional lines were presented last year, with the help of €50 million of EU funding.

These include the Lyteus project, a technology which develops Organic Light-Emitting Diodes that are ‘large area, energy efficient light sources that are ultra-thin, flexible and lightweight’, and the MIRPHAB initiative, which develops miniaturised laser-based systems that can detect the presence of chemicals in gas and liquids.

Speaking at the recent Photonics West conference in San Francisco, CEO of Lightwave Logic, Michael Lebby, who has been closely involved in the process, drew attention to the importance of the EU’s Pilot Lines for Photonics project in ensuring competitiveness.

“Pilot lines takes advanced photonics technologies, and makes more of them. So we’re talking about an increasing number of prototypes and actually being able to help small and medium sized enterprises and tier one companies in providing a manufacturing vehicle for volume in photonics, in Europe.”

Whether or not Europe’s clout in the field of photonics technologies can be sustained at current levels to compete on a level-playing field with China, remains to be seen.

The Commission’s priority to obtain strategic autonomy is entirely dependent on the success and support for such mechanisms as the Pilot Lines initiative, which helps to foster the innovative technologies of the future that may one day be able to stand on their own two feet on the global marketplace.

For Lebby, the continent is only at the beginning of the opportunities that may come forth as part of a broader and more competitive photonics ecosystem. “Europe is gaining a lot of interest in photonics technology, which is really exciting,” he said.
Photonics has been defined as a vital technology in Europe’s future digital transformation as well as helping the bloc achieve broader sustainability goals and strategic autonomy. However, there remains a deficit in public awareness on the technology. EURACTIV caught up with DG Connect’s Lucilla Sioli to find out what photonics can do for Europe’s digital sector and beyond.

Lucilla Sioli is Director for Artificial Intelligence and Digital Industry at the European Commission’s DG Connect.

The technology of photonics is one of the European Commission’s six Key Enabling Technologies of the 21st century. Why, therefore, do you think there is a lack of public knowledge on the power of this technology in particular?

Although everyone is familiar with light, not everyone knows the term ‘photonics’ which is the area of technology dealing with light. New light bulbs, lasers for welding cars, sensors to detect cancer, systems to check food quality, sort waste, help surgeons operate... all of these are examples of applications using photonics.

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The public awareness of the power of photonics has grown steadily in the last years, also because photonics is listed by the European Commission as one of the Key Enabling Technologies. The Commission has emphasised the enormous growth potential this advanced technology presents for Europe.

The biggest hurdle is probably the unusual term “photonics”. When “lasers”, “sensors”, “cameras”, “displays” and so on are mentioned, everybody gets it immediately. But not “photons”. “Photonics” as a term is relatively new. It is not so long ago that automatic text correction software indicated it as a misspelled word! But we are sure that soon photonics will become a term as familiar as “electronics”.

**In terms of the EU’s investment into photonics, how do we compare with other global markets, such as in the US and China?**

In terms of private sector research investment, we compare very well indeed. Recent studies show that the Photonics Industry in Europe invests about 11% of its revenues back into R&D spending, well above what is currently spent in the chemical or telecom sectors. It is a clear sign of the growth phase which photonics is in.

Public funding at EU level is also significant – a recent market study identified some 800 EU Horizon 2020 programme projects totalling over €1.6 billion funding related to photonics (including those of the EU’s Public Private Partnership dedicated to Photonics, which set aside €700 million). On a global scale for markets, Europe is in 2nd place overall and is leading by far in some sectors, like production technologies, or medical devices, and even increasing its global market share of these. However, it is clear that there is an increasing competition, especially from China which has the global market lead (thanks in a large part to its photovoltaics industry), and is also massively investing in publicly funded research.

**Thinking about EU-funded projects working with photonic technologies, where have we seen the greatest success stories?**

We’ve had more than 100 projects funded by the Photonics PPP, and it is estimated that in the Horizon 2020 programme almost 800 photonics-related projects across a wide range of applications were supported. Each of them advanced the field a step further, but we also certainly have star projects. The latest is VOSTARS achieving the world’s first surgery performed with an augmented reality visor. More successes are in the pipeline. Many breakthroughs will end up in products and cannot be disclosed.

**Which sectors do you think benefit the most from a resilient and innovative photonics industry?**

Photonics is a key enabling technology for the whole digital sector and indeed in many applications even beyond ICT in which it is used to sense what is happening, power processes, and transfer data and information. It will help to collect much of the data that Artificial Intelligence needs – it already is the “eyes of the Robots”.

It provides the network on which the Internet operates, e.g. higher speed fibre optic systems for broadband internet, even at its growing speed and reducing its environmental footprint. It will empower most of the Digital Transformation.

However, the ICT sector is not the only one that will be positively impacted. The Commission started long ago to fund projects targeting also traditional industries to introduce photonics into new areas, like agriculture or health and environment protection, for greater efficiency and productivity in manufacturing and industry, and to fully exploit this technology and compete on a global scale. Photonics is going to be essential over the whole spectrum of human activities.

**Can photonics technologies be leveraged in the other priorities of the European Commission? How could photonics be used as part of the executive’s climate goals, for example?**

As an enabling technology, Photonics is poised to contribute to several Commission Priorities. It certainly contributes to the two overarching priorities of this Commission: the Digital

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Transformation, where sensors, cameras and lasers are vital, and the Green Deal, where the use of photonics will have a major impact.

Photonics is an inherently green technology – for example, 3 billion tons less CO2 is the predicted indirect potential impact in 2030 when photonics is employed. From reduced energy consumption in data centres or fertiliser use, through the reduced use of resources in manufacturing, or by enabling new recycling processes and technologies – photonics is a driver of global sustainability.

What new markets can emerge out of the development of photonics technologies?

Advanced photonics technologies have the potential to revolutionise existing application sectors or to create completely new applications and markets. We have seen this happening through the years, in the lighting sectors, for example, or in farming.

The Commission has been supporting this process by developing a Strategic Roadmap together with the Technology Platform Photonics21 and by funding specific projects, like ActPhast, helping SMEs to use photonics and to introduce photonics solution in non-photonics products.

This year we have an open call for proposals on “Disruptive photonics technologies” covering 4 very different areas: 3D light field and holographic displays, Packaging and module integration for photonic integrated circuits, Light to Fuel (converting sunlight directly into fuel) and Next generation biophotonics methods and devices as research tools to understand the cellular origin of diseases.

We know that more is happening in the vibrant photonics landscape. But we can’t always predict how new developments will be used – this is why we need to maintain competence in core or fundamental photonics technologies as well.

Can photonics play a key part in helping Europe to achieve digital sovereignty?

Yes. Photonics has a strong base in Europe, especially in segments like Production Technology, Machine Vision, Optical Components and Medical Technologies. The global market for photonics is expected to continue growing, thanks to the extensive application of photonics in an increasing number of end-use industries, including life sciences, manufacturing, electronics, photovoltaics, security and defence, and information and communications technology.

For this last area, the need to enhance the speed and capacity of data transfer is driving the adoption of Photonic Integrated Circuits in the growing semiconductor industry. It is clear that we need to maintain or acquire sovereignty, as we need to be able to shape and choose the key technologies at the heart of many sectors in our economy and society.
Does Europe lack a financial market for photonics?

By Carlos Lee | EPIC

The photonics industry is an emerging but already consolidating market, with more than 100 acquisitions per year.

Carlos Lee is Director-General of the European Photonics Industry Consortium (EPIC).

The industry itself is 99% hardware based, and the life-cycle for product development is typically longer than for software products. While investors should bear this in mind with regards to their expectations, the benefits of entering the photonics marketplace can be far-reaching, for a technology that impacts so much of our everyday lives.

In 2019, TRUMPF, a German family-owned industrial machine manufacturer with 14,500 employees and €3.8 billion annual revenue,

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acquired the laser division of Philips. Laser diodes are used, for example, in smartphones, in digital data transmission, and in sensors for autonomous driving.

Gimv, a €1 billion investment fund, acquired majority stake in Laser 2000, a leading European supplier of innovative laser and photonics solutions serving renowned companies and research institutes in the fields of automation and sensor technology, optical communications and network technologies, biotech and medicine, automotive and aerospace.

SCHOTT, established in 1884, is a leading international technology group in the areas of specialty glass and glass-ceramics. Schott acquired Primoceler from Finland, a pioneering laser glass micro bonding specialist, enabling innovative hermetic packaging creating new possibilities for protection of sensitive electronics in automotive, aerospace, medical, and energy applications.

Most transactions are small, such as the Zeiss acquisition of Insight Ophthalmic Laser Engines for €19.1 million. But Austria’s ams acquired Heptagon for up to €845 million to become a worldwide leader in optical sensing.

State-owned investments funds have also taken a keen interest in photonics technologies, too. L-GAM, a long-term investment firm established in partnership with the Princely Family of Liechtenstein, invested a majority stake in French laser manufacturer Amplitude Laser Group.

Despite the broad investments and numerous acquisitions, there are only a handful of professional investors concentrated on the photonics market. And as a result, the bulk of financing needs to come from other sources such as private equity and venture capital, debt, public grants, and elsewhere.

Different stages of growth require different investors, and we need to reach out to stakeholders comprehensively from business angels for seed capital all the way to entities that can finance A, B, and C funding rounds. Would it be too farfetched to suggest that Europe lacks a financial market for photonics?

On the collaborative research side, the European Commission invested €540 million in Photonics Public Private Partnership projects in the period 2014-2019. But what one finds missing is a documented compelling story aimed towards “investors”.

For the European market to keep up with its main competitor in the field, China, we should look to mobilise the funding ecosystem for photonics to good effect: analysing trends ranging from the growth stages of companies to the ownership landscape for firms specialising in photonics tech. Investors should be made aware of return rates and exit timeframes, and some of the success stories that help to make Europe fertile ground for the future of photonics.